PATENT

DEHUMIDIFICATION SYSTEM

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CROSS REFERENCE TO RELATED APPLICATIONS:

[0001] Not applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT:

[0002] Not applicable.

REFERENCE TO A SEQUENCE LISTING, A TABLE, OR A COMPUTER PROGRAM LISTING COMPACT DISK APPENDIX:

[0003] Not Applicable.

BACKGROUND OF THE INVENTION:

[0004] The present invention relates to dehumidifiers, and, in particular, to dehumidifier controller systems that regulate ambient humidity of interior and enclosed spaces.

[0005] Appliances for removing moisture from enclosures or interior spaces are known to prevent these areas from becoming damaged. An area very susceptible to damage caused by moisture, such mildew and termite damage is the basement or crawl space of a house. Therefore, the ability for homeowners to maintain reduced moisture levels in the basement can be critical to preserve the structural integrity of the house, as well as to preserve the environment within the basement of the house.

[0006] Another area that is susceptible to moisture damage is the interior space of boats. In particular, the engine rooms and the interior cabins of boats that are stored

at marinas can easily become mildewed, giving the boats a musty odor and damaging the materials of the boats.

[0007] Dehumidifiers are well known for use in removing moisture from the atmosphere. However, typical dehumidifiers require that a user operate the dehumidifier at the location of the unit itself. Further, the controller systems of dehumidifiers are such that the unit is either constantly running or constantly turned off. Therefore, if the user is not diligent in turning the unit on and off based on need, there is a risk that either energy will be wasted or that mildew and moisture damage will persist.

[0008] Accordingly, there exists a need for an effective and convenient dehumidification system for use in areas that are susceptible to moisture damage.

SUMMARY OF THE INVENTION:

[0009] The following presents a simplified summary of the invention in order to provide a basic understanding of some aspects of the invention. This summary is not an extensive overview of the invention. It is not intended to identify key or critical elements of the invention or to delineate the scope of the invention. Its sole purpose is to present some concepts of the invention in a simplified form as a prelude to the more detailed description that is presented later.

[0010] According to its major aspects and briefly stated, the present invention is a dehumidification system including a dehumidifier that is connected to a plurality of fans.

The system further includes a controller having a humidity sensor switch that turns the dehumidifier, as well as the plurality of fans, on and off based on the ambient humidity of the area in which the dehumidification system is placed. Additionally, the dehumidification system includes a user interface unit that is separate or remote from the dehumidifier, and that can be used to operate the dehumidification system from remote locations.

[0011] In an alternative embodiment, the controller of the dehumidification system unit further includes a wood moisture indicator switch. The wood moisture switch works in combination with the humidity switch so that the dehumidifier is turned on or off either by the wood moisture switch or the humidity switch depending on wood moisture and ambient humidity. The user interface includes a number of inputs, as well as a service light, which indicates a need for maintenance or repair.

[0012] A feature of the present invention is the use of a dehumidification system in interior or enclosed spaces such as the crawl space of a house and the engine room of a boat. Not only will the use of a dehumidifier in these areas reduce and prevent the musty odor caused by potential mildew, but also the materials used to construct houses and boats can be better preserved. Further, keeping these areas dry prevents the growth of pests that can be damaging to the area, such as termites.

[0013] Another feature of the present invention is the use of a user interface unit in combination with a dehumidifier. Typically, dehumidifiers must be operated at the

location of the unit itself. Because areas such as the basement or crawl space of a house tend to be small and unfinished, placing a unit in these areas can be unpleasant burdensome on the user of the unit who is forced to constantly enter the basement to operate the unit. A user interface can avoid the need for entering these areas, so that a user can operate the dehumidifier in comfortable and convenient locations within the house.

[0014] Yet another feature of the present invention is the use of a dehumidifier in combination with a plurality of fans. Dehumidifiers tend to include fans within the unit so that moist air is circulated into the unit and dry air is circulated out of the unit. However, if the enclosed area to be dehumidified is relatively large, the dehumidifier may take a long time to dry the air. Through the use of a plurality of fans positioned in various locations around the dehumidifier, the moist air can be more effectively dried. Further, the fans contribute to the improvement of the environment of the interior space by circulating dried and fresh air.

[0015] Still another feature of the present invention is the use of a controller having an ambient temperature sensor wherein the dehumidifier is turned on or off based on a preset, desired humidity level. Accordingly, if the ambient humidity is higher than the desired humidity, the unit will be turned on, and if the ambient humidity is below the desired humidity, the unit is turned off. This switch allows the dehumidifier to remain energy and cost efficient. Further, the user need not monitor the dehumidification system once the desired humidity is programmed.

[0016] The use of a wood moisture switch in combination with a humidity switch is yet another feature of the present invention. By using a combination of switches, the dehumidifier can effectively eliminate and prevent moisture damage of the interior spaces. If the moisture contact is too high in the wood of the interior space, the dehumidifier is started. However, if only the moisture content of the air is too high, rather than the wood, then the dehumidifier is still turned on.

[0017] Yet another feature of the present invention is the use of a user interface having a service light. The service light alerts the user that the dehumidification system is in need of either maintenance or repair. Therefore, the lifespan of the dehumidifier can be prolonged, and its function enhanced.

[0018] Still another feature of the present invention is the use of a dehumidification system that negates the need to seal those interior spaces that are to be dehumidified. It is known that spaces, such as the basements and crawl spaces of houses, can contain levels of harmful gases, such as radon. If these spaced are completely enclosed for the sake of keeping out moisture, such gases can build up and create dangerous, harmful environments to the inhabitants of the house. The present system contributes to the circulation of fresh air throughout the space.

[0019] Other features and advantages of the present invention will be apparent to those skilled in the art from a careful reading of the Detailed Description of the Preferred Embodiments presented below and accompanied by the drawings.

BRIEF DESCRIPTION OF THE DRAWINGS:

In the drawings,

[0020] FIG. 1 is a cross-sectional side view of a house containing a dehumidification system according to a preferred embodiment of the present invention;

[0021] FIG. 2 is a top view of the crawl space of a house containing a dehumidification system according to the preferred embodiment of the present invention;

[0022] FIG. 3 is a front view of a user interface unit of a dehumidification system according to the preferred embodiment of the present invention;

[0023] FIG. 4 is schematic view of the component parts of a dehumidification system according to the preferred embodiment of the present invention;

[0024] FIG. 5 is a cross-sectional side view of a boat containing a dehumidification system according to the preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS:

[0025] The present invention is a dehumidification system **10** for use in interior or enclosed spaces. As illustrated in FIGS. 1 and 2, the dehumidification system **10** includes a dehumidifier **12** that is connected to a plurality of fans **14** and a user interface unit **16**. The system **10** is operated by a controller **20** that can be included either within the vicinity dehumidifier **12** or the user interface unit **16**. Although the dehumidification

system **10** is shown to be located within a crawl space **22** or basement of a house **24**, it is contemplated by the present invention that the dehumidification system **10** can be used within any area of the house **24**, as well as other enclosed areas, such as storage sheds, RVs, and boats.

[0026] A feature of the present invention is the user interface **16**, which can be used to operate the dehumidification system from remote locations. As illustrated in FIG. 3, the user interface **16** can be located within the main portion of the house **24** and be electrically wired, or have a wireless connection, to the dehumidifier **12** that is in the crawl space **22** of the house **24**. Preferably, the user interface unit **16** includes a power input **30** for manually turning the system **10** on or off and a means for selecting a desired humidity **32** by which a user can incrementally adjust up and down the desired humidity of the area in which the dehumidifier **12** is located. The user interface unit **16** further includes a display **34** showing the current temperature and relative humidity of the area containing the dehumidifier, as well as the desired relative humidity, that has been set by the user. Finally, the user interface **16** can include a service light **35** that indicates when the system **10** needs maintenance or repair.

[0027] As shown, all the components of the dehumidification system **10** can be electrically wired and can obtain power by plugging the dehumidifier into a GFI (ground fault interrupter) outlet. Alternatively, the dehumidification system **10** can be operated by remote control, wherein a transmitting device capable of transmitting signals, such as radio or microwave, communicates with a receiver so as to turn the dehumidifier **12** on

or off. Therefore, the system **10** can be completely automated through these connections.

[0028] The dehumidifier **12** can include any conventional arrangement. A typical dehumidifier removes moisture from the air by condensing the moisture from the air on its cooled evaporator coils. In the present invention, the condensed moisture can be collected in a retainer beneath the dehumidifier **12**, and as shown in FIGS. 1 and 2, the condensation can drain into a pipe **40** that is routed to the exterior of the interior or enclosed space. Although a variety of dimensions are suitable for the dehumidifier **12** depending on the particular location needing to be dehumidified, the dehumidifier **12** is preferably less then 20 inches if the dehumidifier **12** is to go into the basement or crawl space of a house. Further, the dehumidifier **12** can be permanently installed next the wall of an interior space needing to be dehumidified.

[0029] A particular feature of the present invention is the use of the dehumidifier **12** in combination with the plurality of fans **14** that are advantageously positioned around the area needing to be dehumidified. Through the use of plural fans positioned in various locations around the dehumidifier **12**, the moist air can be more effectively dried. Further, the fans contribute to the improvement of the environment of the interior space by circulating dried and fresh air. Preferably, the fans will pull less than or approximately 2 Amps of energy. However, more powerful fans are contemplated by the present invention.

[0030] A schematic view of how the various components of the dehumidification system **10** operate is shown in FIG. 4. As illustrated, the user interface unit **16** includes an input section **42**, including the power input **30** and the selecting means **32**, in which a user can program the desired humidity by increasing or decreasing the humidity displayed on display **34**. The user changes the desired humidity using a stepper motor **44** that allows the desired humidity to be changed in increments by sending signals to a desired humidity indicator **46**.

[0031] The programmed or pre-selected desired humidity is compared with the relative ambient humidity, which is measured by a humidity sensor **50**. The humidity sensor **50** can use any instrument for measuring atmospheric humidity, such as a hygrometer, and a thermometer **52**, because relative humidity is temperature sensitive. The humidity sensor **50** measures the actual humidity of the area in which the dehumidifier **12** has been placed. The relative humidity is also displayed on the user interface unit **16**. In operation, the desired humidity and the actual humidity are compared by a first comparator **56**. If the relative humidity is greater than desired humidity, then the dehumidifier **12** and the plurality of fans **14** are turned on, and if the relative humidity is less than the desired humidity **12**, then the dehumidifier **12** and the plurality of fans **14** are turned off. Because the dehumidification system **10** is completely automated, a user need simply program a desired humidity and the system will thereafter operate itself to maintain this desired humidity. In an alternative embodiment, each fan of the plurality of fans **14** can include a relative humidity sensor and a desired humidity

indicator so that the fans can turn on independently of the system **10** and prevent the entire system **10** failing in the case one of the fans malfunctions.

[0032] As previously discussed, the dehumidification system **10** can also include a wood moisture sensor **60** that is used in combination with a humidity sensor **50**. Although the system **10** need only contain one of these indicators, the use of a combination of indicators contributes to the prevention of moisture damage of the interior spaces containing the system **10**. If the moisture content is too high in the wood of the interior space, dehumidifier **12** is started. However, if only the moisture content of the air is too high, rather than the wood, then the dehumidifier **12** will still be turned on. As with the humidity sensor **50**, the actual wood moisture measured by the wood moisture sensor **60** is compared by a second comparator **64** to a pre-selected desired wood moisture, which is selected by a means for selecting a desired wood moisture **62**, and depending on whether the actual wood moisture is higher or lower than the desired wood moisture, the dehumidifier **12** and the plurality of fans **14** are turned on or off. If the wood moisture sensor **60** and the humidity sensor **50** are used in combination, the system **10** preferably includes an "or" gate **70**, wherein the information of the first comparator **56** and the information of the second comparator **64** is sampled by a clock **72** so that the dehumidifier **12** and the plurality of fans **14** will be turned on if either the humidity or the wood moisture require it.

[0033] The controller **20** of the system **10** can contain the sensor and indicator components, as illustrated in FIG. 4. However, it is also contemplated that the sensor

and indicator components are removed from the controller **20** so that the controller need not remain in the vicinity of the dehumidifier **12**.

[0034] The clock **72** of the system **10**, in addition to driving the repetition of comparisons of humidity at short intervals, also indicates on the display **34** through the service light **35** a need for a maintenance or check up of the system **10** based on an preset maintenance intervals. Further, the service light **35** can also indicate that the system **10** is somehow malfunctioning and needs to be repaired. The service light **35** is advantageous because it serves a warning to the user of the system **10**. Therefore, the lifespan of the dehumidification system **10** can be prolonged, and its function enhanced.

[0036] In an alternative embodiment, the dehumidification system is connected to a centrally located alarm system (not shown), similar to a burglar alarm system. Each component of the system 10 would be monitored by the alarm system so that if any one component or a combination of components malfunctioned, the alarm system would be triggered, and those monitoring the system would initiate repair.

[0037] Figure 5 represents the dehumidification system **10** of the present invention in use in a boat **80**. In particular, the dehumidification system can be used in the state rooms or the engine room of the boat **80**. Another area to benefit from the use of the system **10** is in an RV **90**, as illustrated in FIG. 6. Both of these vehicles include many enclosed areas that may be susceptible to moisture damage. Although the system **10**

in FIGS. 5 and 6 is shown to include the plurality of fans **14**, it is contemplated that the system **10** would not be required in these areas, or other small areas.

[0038] A feature of the present invention is the use of a dehumidification system **10** in interior or enclosed spaces. Accordingly, any area that tends to become musty and mildewed is suitable for the dehumidification system **10**. Not only will the use of a dehumidification system **10** in these areas reduce and prevent the musty odor caused by potential mildew, but also the materials used in these areas can be better preserved.

[0039] Finally, there are many alternative embodiments and modifications of the present invention that are intended to be included within the spirit and scope of the following claims.